

CLAIMS

1. A prepolymer, prepared by reacting a mixture comprising:

- (a) at least one multifunctional compound,
- (b) at least one diisocyanate, and
- (c) at least one diol,

wherein said diol has a weight average molecular weight of at most 7000,

said prepolymer has a viscosity of at most 100,000 cps at 70°C, and

said prepolymer, when reacted with an excess of water, forms a hydrogel polymer.

2. A prepolymer, prepared by reacting a mixture comprising:

- (a) at least one triisocyanate,
- (b) at least one diisocyanate, and
- (c) at least one polyalkylene oxide,

wherein a molar ratio of (a):(b):(c) in said mixture is 0.9-1.1:1.8-3.3:1.2-3.3,

said at least one polyalkylene oxide has a weight average molecular weight of at most 7000, and

said prepolymer, when reacted with an excess of water, forms a hydrogel polymer.

3. A prepolymer, prepared by reacting a mixture comprising:

- (a) at least one triol,
- (b) at least one diisocyanate, and
- (c) at least one polyalkylene oxide,

wherein a molar ratio of (a):(b):(c) in said mixture is 0.9-1.1:1.8-2.2:4.5-5.5,

said at least one polyalkylene oxide has a weight average molecular weight of at most 7000, and

said prepolymer, when reacted with an excess of water, forms a hydrogel polymer.

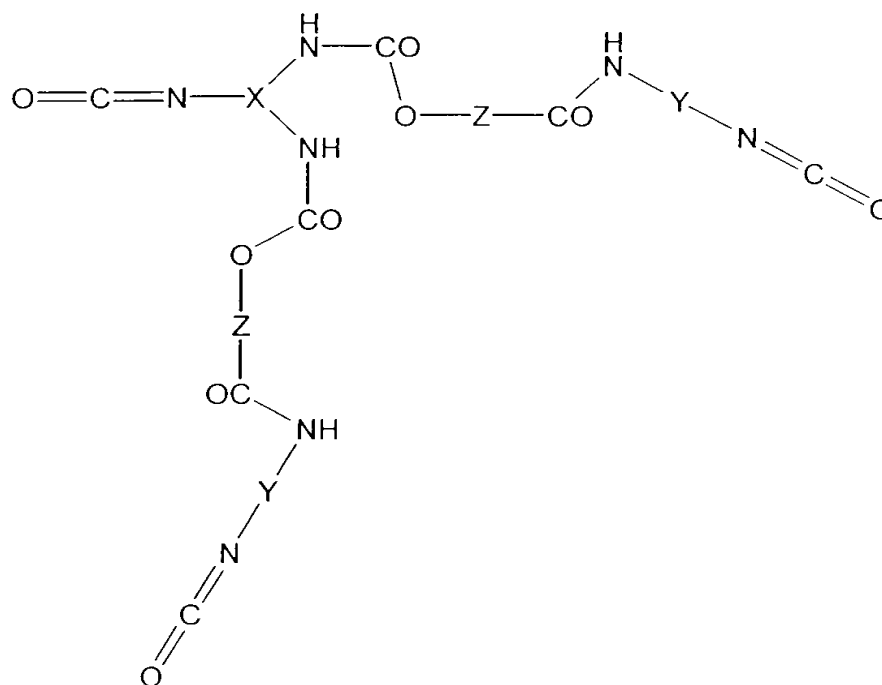
4. The prepolymer of Claim 2, wherein said molar ratio of (a):(b):(c) in said mixture is 0.97-1.1.03:1.94-2.06:1.94-2.06, and
5 said at least one polyalkylene oxide has a weight average molecular weight of 1000-2000.

5. The prepolymer of Claim 3, wherein said molar ratio of (a):(b):(c) in said mixture is 0.97-1.1.03:1.94-2.06:4.85-5.15, and
10 said at least one polyalkylene oxide has a weight average molecular weight of 1000-2000.

6. The prepolymer of Claim 4, wherein said prepolymer has a viscosity of 1000 to 50,000 cps at 70°C.

7. The prepolymer of Claim 5, wherein said prepolymer has a viscosity of 1000 to 50,000 cps at 70°C.

15 8. A prepolymer of formula I:



Formula I

wherein X is a trivalent organic group containing 3-20 carbon atoms;

Y is a divalent organic group containing 3-20 carbon atoms;

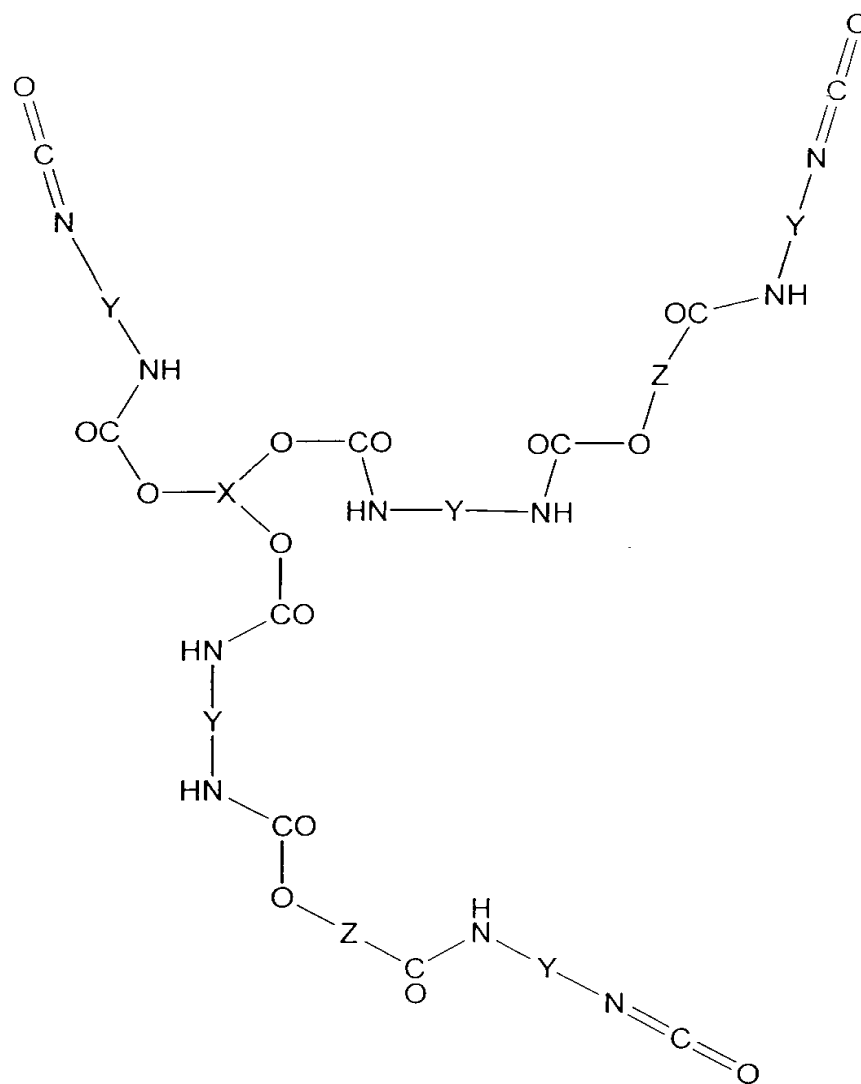
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Z is an oligomer consisting of monomer units selected from the group consisting of $-(CH_2-CH_2-O)-$, $-(CH_2-CH(CH_3)-O)-$, $-(CH(CH_3)-CH_2-O)-$, $-(CH_2-CH(CH_2-CH_3)-O)-$, $-(CH(CH_2-CH_3)-CH_2-O)-$ and $-(CH(CH_3)-CH(CH_3)-O)-$, and

Z has a weight average molecular weight of at most 7000.

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9. A prepolymer of formula II:



Formula II

wherein X is a trivalent organic group containing 3-20 carbon atoms;

5 Y is a divalent organic group containing 3-20 carbon atoms;

Z is an oligomer consisting of monomer units selected from the group consisting of $-(CH_2-CH_2-O)-$, $-(CH_2-CH(CH_3)-O)-$, $-(CH(CH_3)-CH_2-O)-$, $-(CH_2-CH(CH_2-CH_3)-O)-$, $-(CH(CH_2-CH_3)-CH_2-O)-$ and $-(CH(CH_3)-CH(CH_3)-O)-$, and

10 Z has a weight average molecular weight of at most 7000.

10. The prepolymer of Claim 8, wherein
Y is a divalent aliphatic group,
Z has a weight average molecular weight of 1000-2000, and
said prepolymer has a viscosity of 1000 to 50,000 cps at 70°C.
- 5 11. The prepolymer of Claim 9, wherein
Y is a divalent aliphatic group,
Z has a weight average molecular weight of 1000-2000, and
said prepolymer has a viscosity of 1000 to 50,000 cps at 70°C.
- 10 12. A mixture, comprising:
(i) water, and
(ii) the prepolymer of Claim 2.
13. A mixture, comprising:
(i) water, and
(ii) the prepolymer of Claim 3.
- 15 14. A mixture, comprising:
(i) water, and
(ii) the prepolymer of Claim 8.
- 20 15. A mixture, comprising:
(i) water, and
(ii) the prepolymer of Claim 9.
16. The mixture of Claim 12, consisting essentially of:
(i) said water, and
(ii) said prepolymer.
- 25 17. The mixture of Claim 13, consisting essentially of:
(i) said water, and
(ii) said prepolymer.

18. The mixture of Claim 14, consisting essentially of:

- (i) said water, and
- (ii) said prepolymer.

19. The mixture of Claim 15, consisting essentially of:

- (i) said water, and
- (ii) said prepolymer.

20. The mixture of Claim 12, wherein said mixture has a viscosity of 15 to 500 cps at 50°C.

21. The mixture of Claim 13, wherein said mixture has a viscosity of 15 to 500 cps at 50°C.

22. The mixture of Claim 14, wherein said mixture has a viscosity of 15 to 500 cps at 50°C.

23. The mixture of Claim 15, wherein said mixture has a viscosity of 15 to 500 cps at 50°C.

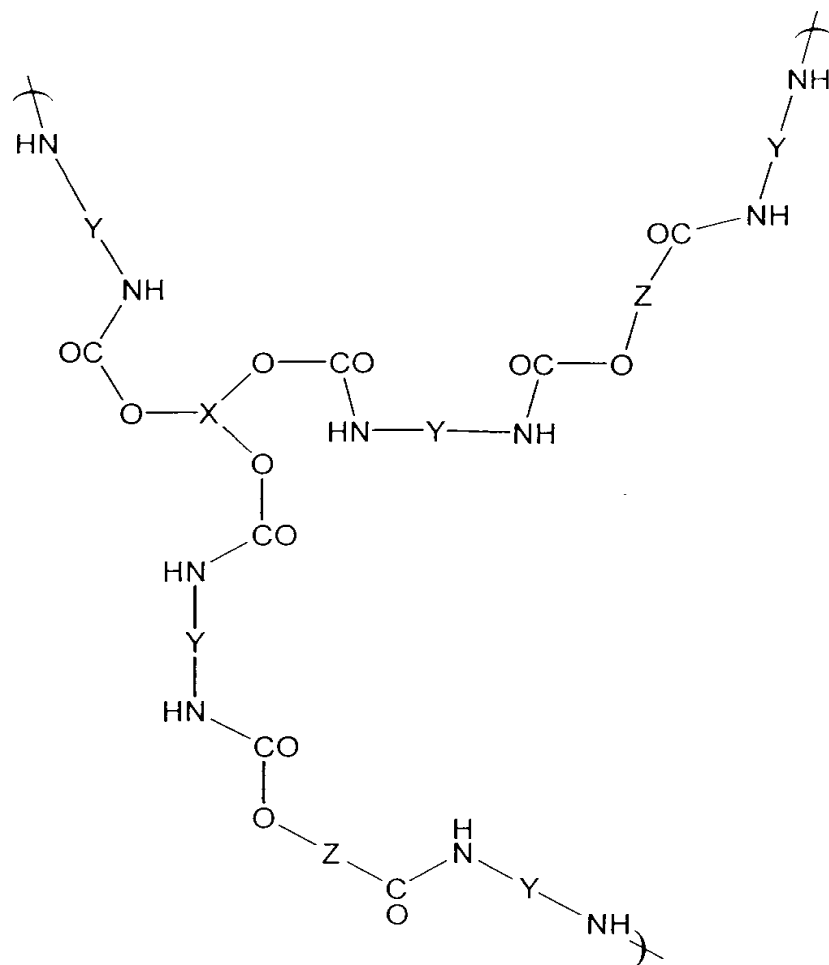
24. A polyurethane hydrogel, prepared by reacting the prepolymer of Claim 2 with an excess of water.

25. A polyurethane hydrogel, prepared by reacting the prepolymer of Claim 3 with an excess of water.

26. A polyurethane hydrogel, prepared by reacting the prepolymer of Claim 8 with an excess of water.

27. A polyurethane hydrogel, prepared by reacting the prepolymer of Claim 9 with an excess of water.

28. A polyurethane hydrogel, comprising units of formula III



Formula III

wherein X is a trivalent organic group containing 3-20 carbon

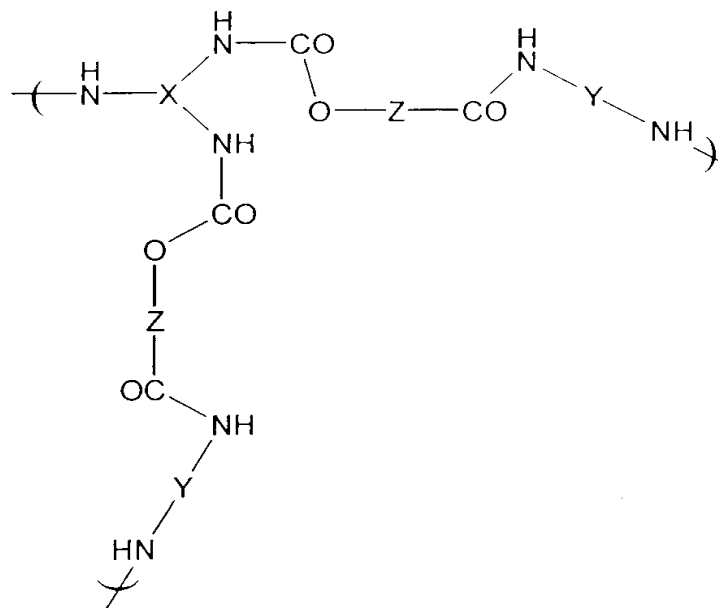
5 atoms;

Y is a divalent organic group containing 3-20 carbon atoms;

Z is an oligomer consisting of monomer units selected from the
group consisting of $-(CH_2-CH_2-O)-$, $-(CH_2-CH(CH_3)-O)-$, $-(CH(CH_3)-CH_2-O)-$,
 $-(CH_2-CH(CH_2-CH_3)-O)-$, $-(CH(CH_2-CH_3)-CH_2-O)-$ and $-(CH(CH_3)-CH(CH_3)-O)-$,
10 and

Z has a weight average molecular weight of at most 7000.

29. A polyurethane hydrogel, comprising units of formula VI



Formula VI

wherein X is a trivalent organic group containing 3-20 carbon

5 atoms;

Y is a divalent organic group containing 3-20 carbon atoms;

Z is an oligomer consisting of monomer units selected from the group consisting of $-(CH_2-CH_2-O)-$, $-(CH_2-CH(CH_3)-O)-$, $-(CH(CH_3)-CH_2-O)-$, $-(CH_2-CH(CH_2-CH_3)-O)-$, $-(CH(CH_2-CH_3)-CH_2-O)-$ and $-(CH(CH_3)-CH(CH_3)-O)-$,

10 and

Z has a weight average molecular weight of at most 7000.

30. The polyurethane hydrogel of Claim 28, wherein

Y is a divalent aliphatic group, and

Z has a weight average molecular weight of 1000-2000.

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31. The polyurethane hydrogel of Claim 29, wherein

Y is a divalent aliphatic group, and

Z has a weight average molecular weight of 1000-2000.

32. A contact lens, comprising the polyurethane hydrogel of Claim 24.

33. A contact lens, comprising the polyurethane hydrogel of Claim 25.

5 34. A contact lens, comprising the polyurethane hydrogel of Claim 26.

35. A contact lens, comprising the polyurethane hydrogel of Claim 27.

10 36. A method of forming a contact lens, comprising:
molding the mixture of Claim 12, to form a contact lens.

37. A method of forming a contact lens, comprising:
molding the mixture of Claim 13, to form a contact lens.

38. A method of forming a contact lens, comprising:
molding the mixture of Claim 14, to form a contact lens.

15 39. A method of forming a contact lens, comprising:
molding the mixture of Claim 15, to form a contact lens.

40. The method of Claim 36, wherein said contact lens is formed in a fully hydrated state.

20 41. The method of Claim 37, wherein said contact lens is formed in a fully hydrated state.

42. The method of Claim 38, wherein said contact lens is formed in a fully hydrated state.

43. The method of Claim 39, wherein said contact lens is formed in a fully hydrated state.

44. A method of forming a contact lens, comprising:
molding a mixture comprising (a) a prepolymer, and (b) water, to
form a contact lens,
wherein said contact lens comprises a polyurethane hydrogel,
5 and
said contact lens is formed in a fully hydrated state.

45. The method of Claim 44, wherein said prepolymer has a
viscosity of at most 100,000 cps at 70°C.

46. The prepolymer of Claim 44, wherein said prepolymer has a
10 viscosity of 1000 to 50,000 cps at 70°C.

47. The method of Claim 36, wherein said molding is carried out
with a circular turntable installation having a plurality of molding stations.

48. The method of Claim 37, wherein said molding is carried out
with a circular turntable installation having a plurality of molding stations.

49. The method of Claim 38, wherein said molding is carried out
15 with a circular turntable installation having a plurality of molding stations.

50. The method of Claim 39, wherein said molding is carried out
with a circular turntable installation having a plurality of molding stations.

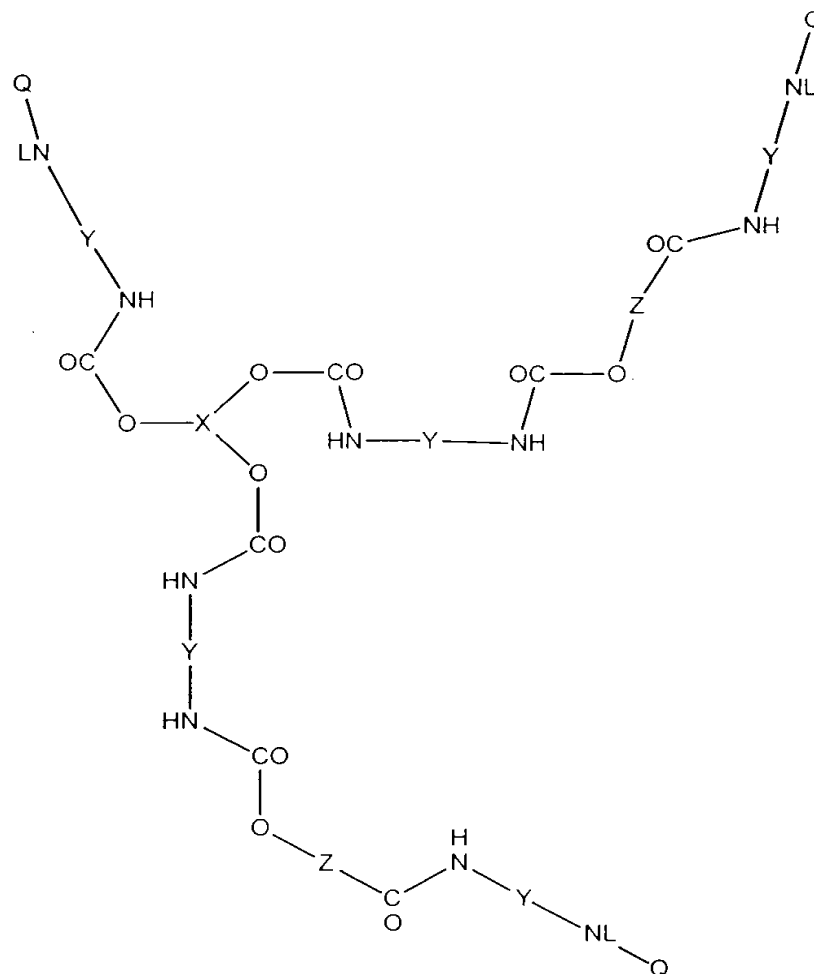
51. The method of Claim 44, wherein said molding is carried out
20 with a circular turntable installation having a plurality of molding stations.

52. The method of Claim 45, wherein said molding is carried out
with a circular turntable installation having a plurality of molding stations.

53. The method of Claim 36, wherein said molding is one member
selected from the group consisting of cast molding, thermoforming,
25 compression molding, and injection molding.

54. The method of Claim 53, wherein said injection molding is reactive injection molding.

55. A precursor to a polyurethane hydrogel having Formula (VIII):



Formula (VIII)

wherein X is a trivalent organic group containing 3-20 carbon atoms;

Y is a divalent organic group containing 3-20 carbon atoms;

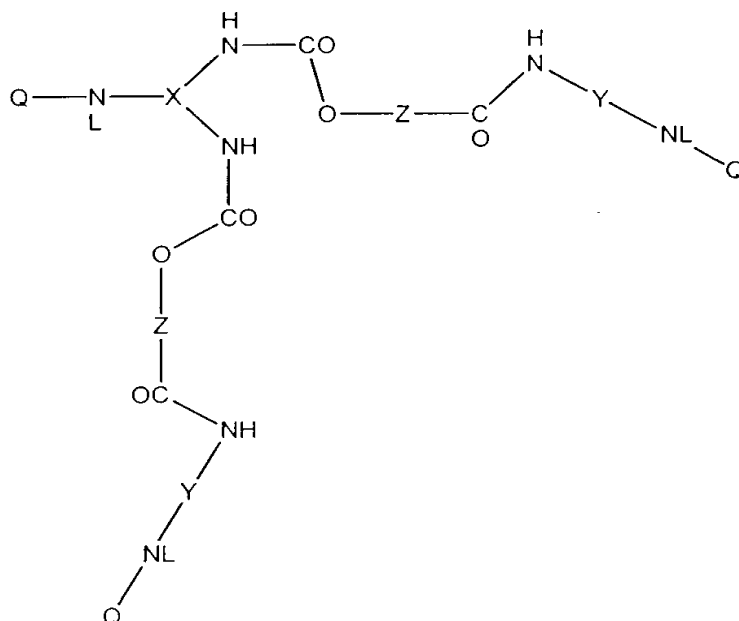
Z is an oligomer consisting of monomer units selected from the group consisting of $-(CH_2-CH_2-O)-$, $-(CH_2-CH(CH_3)-O)-$, $-(CH(CH_3)-CH_2-O)-$, $-(CH_2-CH(CH_2-CH_3)-O)-$, $-(CH(CH_2-CH_3)-CH_2-O)-$ and $-(CH(CH_3)-CH(CH_3)-O)-$, and

Z has a weight average molecular weight of at most 7000,

L is either hydrogen or forms a double bond, and Q is selected from the group consisting of carboxylic acid, hydrogen and O=C, provided that when Q is O=C, L forms a double bond between nitrogen and the carbon atom of the carbonyl.

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56. A precursor to a polyurethane hydrogel having Formula (IX):



Formula (IX)

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wherein X is a trivalent organic group containing 3-20 carbon atoms;

Y is a divalent organic group containing 3-20 carbon atoms;

Z is an oligomer consisting of monomer units selected from the group consisting of $-(CH_2-CH_2-O)-$, $-(CH_2-CH(CH_3)-O)-$, $-(CH(CH_3)-CH_2-O)-$, $-(CH_2-CH(CH_2-CH_3)-O)-$, $-(CH(CH_2-CH_3)-CH_2-O)-$ and $-(CH(CH_3)-CH(CH_3)-O)-$, and

15

Z has a weight average molecular weight of at most 7000,

L is either hydrogen or forms a double bond, and Q is selected from the group consisting of carboxylic acid, hydrogen and O=C, provided that

when Q is O=C, L forms a double bond between nitrogen and the carbon atom of the carbonyl.